

## ABSTRACT OF THE DISCLOSURE

10099705.031402

A synthetic aperture ladar system using a mode locked laser transmitter. The  
5 inventive system (12) includes a mode locked laser transmitter (22); a receiver (40)  
adapted to detect signals transmitted by said laser (22) and reflected by an object (32)  
and a signal processor (50) for analyzing the signals. The laser (22) is particularly novel  
as a synthetic aperture ladar transmitter inasmuch as it includes a mode locking  
mechanism (180). The mode locking mechanism (180) causes the laser to output energy  
10 at all modes within the gain profile in phase with one another. The result is a series of  
coherent pulses which may be used for synthetic aperture ladar applications. In a  
particular embodiment, the present teachings are implemented in a multifunctional laser  
which, in its operational mode, outputs a mode locked beam for synthetic aperture ladar.

In the illustrative embodiment, the laser is an erbium or erbium, ytterbium-doped, fiber  
15 pumped laser and the mode locking mechanism is a passive quantum well absorber  
crystal or an active acoustic crystal mounted in the laser cavity. In any event, the return  
signals are received and processed to extract range and cross-range imaging information.  
To this end, the signal processor (50) includes a range de-multiplexer (206) for  
organizing the return signals into range bins. For each range bin, the signal processor  
20 (50) applies a Fast Fourier Transform (210) and centroid detection algorithm (212) to  
extract a signal representing Doppler frequencies for each range bin. In addition, the  
signal processor (50) may also extract a signal representing intensity for each range bin.